



Philosophical Transactions

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A Serie's of Quere's propounded by Mr. Isaac Newton, to be determin'd by Experiments, positively and directly concluding his new Theory of Light and Colours ; and here recommended to the Industry of the Lovers of Experimental Philosophy, as they were generously imparted to the Publisher in a Letter of the said Mr. Newtons of July 8. 1672.

IN the mean while give me leave, Sir, to insinuate, that I can not think it effectual for determining truth, to examin the several waies by which Phænomena may be explained, unless where there can be a perfect enumeration of all those waies. You know, the proper Method for *inquiring* after the properties of things is, to deduce them from *Experiments*. And I told you, that the *Theory*, which I propounded, was evinced to me, not by inferring 'tis thus because not otherwise, that is, not by deducing it only from a confutation of contrary suppositions, but by deriving it from *Experiments* concluding positively and directly. The way therefore to examin it is, by considering, whether the *Experiments* which I propound do prove those parts of the *Theory*, to which they are applyed ; or by prosecuting other *Experiments* which the *Theory* may suggest for its examination. And this I would have done in a due Method ; the *Laws of Refraction* being throughly inquired into and determined before the nature of *Colours* be taken into consideration. It may not be amiss to proceed according to the *Series* of these *Queris* ; which I could wish were determined by the Event of proper *Experiments* ; declared by those that may have the curiosity to examin them.

1. Whether rays, that are *alike* incident on the same *Medium*, have *unequal* refractions ; and how great are the inequali-
ties of their refractions at any incidence ?

2. What is the *Law* according to which each ray is more or less refracted ; whether it be that the same ray is ever refracted according to the same *ratio* of the sines of incidence and refraction ; and divers rays, according to divers *ratio's* ; or that the refraction of each ray is greater or less without any certain rule ? *That is*, whether each ray have a certain degree of refrangibility according to which its refraction is performed ; or is refracted without that regularity ?

3. Where-

3. Whether rays, which are endued with particular degrees of refrangibility, when they are by any means separated, have particular colours constantly belonging to them; *viz.* the least refrangible, *Scarlet*; the most refrangible, *deep Violet*; the middle, *sea-green*; and others, other colours? And on the contrary?

4. Whether the colour of any sort of rays apart may be changed by refraction?

5. Whether colours by coalescing do really change one another to produce a new colour, or produce it by mixing only?

6. Whether a due mixture of rays, indued with all variety of colours, produces Light perfectly like that of the Sun, and which hath all the same properties, and exhibits the same *Phænomena*?

7. Whether the component colours of each mixture be really changed; or be only separated, when from that mixture various colours are produced again by Refraction?

8. Whether there be any other colours produced by refraction than such, as ought to result from the colours belonging to the diversly refrangible rays by their being separated or mixed by that refraction?

To determine by Experiments these and such like *Quære's* which involve the propounded Theory, seems the most proper and direct way to a conclusion. And therefore I could wish all objections were suspended, taken from *Hypotheses* or any other heads than these two; Of shewing the insufficiency of Experiments to determine these *Quære's* or prove any other parts of my Theory, by assigning the flaws and defects in my conclusions drawn from them; Or of producing other Experiments which directly contradict me, if any such may seem to occur. For if the Experiments, which I urge, be defective, it cannot be difficult to show the defects; but if valid, then by proving the Theory they must render all Objections invalid.

So far this accurate Proposer; whose Method appearing to be most genuine and proper to the purpose it is propounded for, and deserving therefore to be considered and put to trial by Philosophers, abroad as well as at home; the Publisher, to invite and gratify Forraigners, was willing to deliver the above recited Extract of Mr. Newton's Letter in the language also of the Learued, as followeth; Z z z z 2 Ex-

Excerptum ex *Isaaci Newtoni* Epistola, nuper ad Editorem script, quā ipse genuinan suggerit Methodum, doctrinam suan de *Luc & Cotoribus*, antehac propositam, evincendi, subjectā certorum *Quæstorum*, debit is Experimentis solvendorum, serie.

Liceat mihi hac occasione tibi significare, nequaquam censere me, efficacem eam esse determinande veritatis rationem, quā diversi examinantur me di, quibus Phenomena explicari possunt, nisi ubi perfecta fuerit omnium istorum mōdorum Enumeratio. *Nosti*, genuinam proprietates rerum investigandi Methodum esse, quā illa ab Experimentis deducuntur. *Ac* jam antē tibi dixeram; *Theoriam* à me propositam evictam mihi fuisse, non quidem infērendo rem ita se habere quia hāud se habeat aliter, i. e. non eam deducendo duntaxat à contrariarum suppositionum confutacione; sed ipsam ab Experimentis, positivè & directe concludentibus, derivando. *Ve-*ra itaque ratio eam examinandi hāc erit, si consideremus scilicet, num Experimenta à me proposita illas *Theoria* partes, quibus accommodantur, reverā probent; vel si alia prosequamur Experimenta, que ab ipsa *Theoria* ad examinandam eam suggerantur. Atque hoc ipsum Methodo genuinā fieri velim; per vestigatis primum ac determinatis Legibus Refractionis, priusquam Colorum natura disquiratur. *Preter* rem itaque hāud fore crediderim, disquisitionem hanc ex sequentium *Quæstorum* serie instituere; quæ quidem ut à soleribus sagacibusque natura *Mystis*, pronunciatis Experimentorum Eventibus, dirimantur, in votis quām maximè habeo. *Ea* sunt;

Primò, *Num* radii, qui à equali incidentiā in idem medium incidunt, *Re-*fractiones habeant inæquales; *quantaque* sint refractionum, quas illi subeunt, *inqualitatis* in quavis incidentia?

Secundò, *Quānam* ea *Lex* sit, juxta quam radius quilibet magis minusve refringitur? sūnē, quod idem radius semper refringatur secundūm eandem rationem *Sinuum Incidentiæ* & *Refractionis*; diversi autem radii, secundūm rationes diversas? *An* verò, quod cujuslibet radii refractio major minörve sit absque ulla regula certa? *Hoc* est, *Utrum* unusquisque radius certum bābeat gradum *Refrangibilitatis*, juxta quem sit ipsius refractio; *an* verò refringatur sine ista regularitate?

Tertiò, *Num* radii, certis gradibus refrangibilitatis prædicti, quando, quod enim cumque modo, secernantur, certos obtineant colores ipsi proprios; *puto* radii minörē omnium refrangibiles, *Coccineum*; maxime refrangibiles, *sa-*turum *Violaceum*; intermedii, *sub-Viridem*; *alii*, *alios*? *Et* e *contra*.

Quartò, *Num* color cujusvis generis radiorum seorsim existentium mutari possint Refractione?

Quintò, *Utrum* colores coalescendo reverā se invicem mutent ad producendum colorem novum; *an* vero cum producant nonnisi se invicem comiscendo?

Sextò, *Num* debita radiorum miscela, omnigenā colorum varietate prædicta, *Lucem* producat Solari luci simillimam; *queaque* easdem omnino proprietates obtineant, eademque *P'hanom'na* exhibeat?

Septimò, Utrum componentes cuiusvis miscela colores revera mutentur; an vero secernantur duntaxat, quando ex mixtura illa varii colores rursum producuntur per Refractionem?

Ottavò, Denturne ulli alii colores Refractione producti prater eos, quos oriri oportet à Coloribus, ad radios diversimode refrangibiles pertinentibus, dum illi refractione ista secernuntur vel miscontrunt?

Per Experimenta determinare hec similiave *Quæsita*, que propositam Theoriam involunt, maximè genuina directaque videtur ad Conclusionem via: Proindeque omnes velim Objectiones suspendi, quæ ab Hypothesibus desumuntur ullisive Fontibus aliis, quam his duobus; quibus nempe vel ostendatur Experimentorum ad determinanda hec *Quæsita* probandausve illas arias Theoria mea partes insufficientia, hallucinationes defectusque in Conclusionibus meis inde deductis indigitando; vel alia producantur Experimenta, è diametro mihi opposita, si que talia occurrere videantur. Si enim Experimenta, que à me urgentur, laborant defectibus, difficile hanc fuerit eos ostendere; si vero valida fuerint, eo ipso dum Theoriam meam afferunt probantque omnes Objectiones convallunt.

Some Annotations of the Learned Dr. Walter Needham upon a Discovery pretended to have been made by the famous Monsieur Pecquet of a Communication between the Ductus Thoracicus and the Inferior Vena Cava.

The Relation it self of that pretended Discovery, as it is to be found in the Journal des Scavans, of Feb. 8. 1672.

THE Discovery made about twenty years since by M. Pecquet of the *Ductus Thoracicus*, seemed not sufficient to clear up all the Difficulties to be met with in the New opinion, which this Channel hath occasion'd, concerning Sanguification.

It might be said among other things, That there appears no reason, why Nature, which does nothing without design, should carry the matter of the Blood into the *Sub-clavials*, and thence make it descend by the Trunk of the *Vena Cava*, (A,) unless it be to keep the Chyle from entring all at once and altogether pure into the Heart, and that the mixture, which is made of the Chyle with the Blood along this way, may dispose the Chyle, by a kind of contagious fermentation the

The Annotations of Dr. Needham.

(A.) I think the reason there mentioned to be very sufficient for the inserting of the Trunk of the *Ductus Thoracicus* into one place alone; at least as good as any that are afterwards given to prove the contrary. For, all proofs of this nature are but loose conjectures at the best: the matter admitting of no other demonstration than what is ocular.

(B.) Till the Lower insertion be shewed, we are bound to believe, that Nature thought the single more